18. (Amended) The backup and retrieval system of claim 16 wherein the media software component [software] creates an index of information on the location of archived information on the at least one backup device, and communicates at least part of the index of information to the management software component [software].

19. (Amended) The backup and retrieval system of claim 16 wherein the management software component [software] and the media software component [software] operate on different computing devices.

20. (Amended) The backup and retrieval system of claim 16 wherein the management software component [software] and the media software component [software] operate on the same computing device.

REMARKS

In the most recent Office Action dated November 14, 2002, the Examiner rejects claims 1-21 under 35 USC § 102(e) as anticipated by the European Patent Application (EP0899662 A1) of Stephen Gold and Jon Bathie, hereafter "Gold and Bathie". As discussed in the interview, the applicants cancel claims 1-5 and amend claims 6, 11, and 16 to more fully claim aspects of the present invention. For at least the reasons set forth below, the applicants respectfully assert that the pending claims are patentable over the prior art of record and request their allowance.

As discussed in the interview, Gold and Bathie does not contain any suggestion or teaching of a plurality of media software agents. By contrast, the system discussed in Gold and

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Bathie uses a single backup server that is responsible for performing all backups and restores in the network. Thus, unlike applicants' system, the system discussed in Gold and Bathie does not have the ability to load balance backups and restores, since processing tasks cannot be spread among a plurality of media software components. In the system described in Gold and Bathie, processing requirements for the single backup server described in Gold and Bathie will increase proportionately to the amount of data being backed up or restored by the single backup server. Indeed, one important advantage offered by the present system is to eliminate the processing bottlenecks caused by the very architecture discussed in Gold and Bathie.

Thus, Gold and Bathie does not disclose or suggest, as set forth in applicants' claim 6, a backup and retrieval system operating on a first network device and a second network device, the backup and retrieval system comprising: a management software component that operates on the first network device; a plurality of media software components communicatively coupled to the management software component that operate on at least a second network device; a storage device communicatively coupled to the media software components; the management software component selects a media software component among the plurality of media software components and controls the selected media software component; and the selected media software component controls backup data to the storage device. For at least the above reasons, and as further discussed in the interview, claim 6 is patentable over the cited art.

Thus, Gold and Bathie does not disclose or suggest, as set forth in applicants' claim 11, a backup and retrieval system operating across a network containing a plurality of network devices, the backup and retrieval system comprising: a management software component that operates on the first network device of the plurality of network devices; a plurality of media software components communicatively coupled to the management software

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component; a storage device communicatively coupled to the media software components, the media software components controlling backups to the storage device; and the management software component selects a media software component among the plurality of media software components and controls the selected media software component. For at least the above reasons, and as further discussed in the interview, claim 11 is patentable over the cited art.

Gold and Bathie also does not disclose or suggest, as set forth in applicants' claim 16, a backup and retrieval system for a network, the network comprising a plurality of computing devices, the plurality of computing devices comprising a first computing device and a second computing device, the backup and retrieval system comprising: a management software component running on the first computing device; a plurality of media software components communicatively coupled to the management software component; at least one backup device communicatively coupled to the media software components; a client software component communicatively coupled to the management software component and the media software components; wherein the media software components control the at least one backup device; the management software component controls the media software components; the client software component controls backups of any particular computing device; and at least one of either the media software components or the client software component runs on the second computing device. For at least the above reasons, and as further discussed in the interview, claim 16 is patentable over the cited art.

The dependent claims of the present application contain additional features that further substantially distinguish the invention of the present application over Gold and Bathie and the other prior art of record. However, given the applicants' position on the patentability of the independent claims, it is not deemed necessary at this point to delineate such distinctions.

New claims 22-51 are being added following the suggestion made by the Examiner at the interview that these features as claimed further distinguish the invention over the prior art of record.

For at least all of the above reasons, Applicants respectfully request that the Examiner withdraw all rejections, and allowance of all the pending claims is respectfully solicited. To expedite prosecution of this application to allowance, the examiner is invited to call the applicants' undersigned representative to discuss any issues relating to this application.

Respectfully submitted,

Dated: July 10, 2003

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I hereby certify that the correspondence attached herewith is being deposited this date with the U.S. Postal Service as first class mail and addressed to: Commissioner for Patents, Alexandria, VA 22313:

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network devices and their need for backup. The manager module would also set the proper library media to which to direct the backup material.

The manager module 115 may also dynamically keep track of the parameters for the backup process, and may alter the scheduling or level of backup dynamically based on the particular network device's or the backup devices's limitations. The manager module 115 may also dynamically alter the backup scheduling or other administrative aspects of a particular backup based on the condition of the network 100 and its usage.

The network devices 110, 120, 130, and 150 contain media modules 116, 126, 136 [and 156], respectively. The media modules communicate with the manager module 155, and coordinate backups to the respective library media. Each media module is responsible for the archival functions of a logical library media. As such, the particular media module would coordinate the actions of the storage device which it is responsible for with the manager module.

For example, if the manager module 115 determined that network device 130 is ready for a backup, the media module would initiate a backup to a single storage device, or media library or libraries. The manager module 115 could determine that the backup of the network device 130 should be directed to the library media 122. The backup data from the network device 120 would be directed to the media module 126 on the network device 120 via a network 100, where the media module 126 would direct the physical backup of the data from the network device 120 onto the library media 122.

It should be noted that the manager module 115 could direct the backup of the network devices 120, 130, 140, or 150 through contacting the and directing the client modules 127, 137, 147, or 157. The files and/or data units to be backed up from any of

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network device 130. These parameters may include requesting a change in scheduling, setting the priorities of the files and/or data to be archived in the case where the services are to be rationed or split across different types of library media.

The manager module 115, after determining that the network device 130 is in need of a backup, could communicate with the client module 137 to initiate the backup. the manager module 115 could indicate the specific media module or modules to which the client component should send the data and/or files to be backed up. The client component 137 could then initiate a direct communication with the specific media module or modules for transmissions of the backup. For example, if the manager module determines that the library media 122 is to be used in the particular backup of the network device 130, the manager module would indicate to the client module 137 that the media module 126 will be responsible of the backup.

In response, the client module 137 will direct the data and/or files directly to the media module 126. there, the media module 126 would direct the actual archive of the data on the backup device the media module 126 is responsible for. It should be noted that the other client modules [117] 127, 147, and 157 could be similarly directed. Thus, data and/or files on many different network devices may archive data to many different library media.

It should be understood that the modules indicated in Fig. 1 may be subdivided into further functional units. Thus, the single manager module, media module, and client module may actually comprise several interconnected functional modules.

Fig. 2 is a logical block diagram of the various functional aspects that the software agents of Fig. 1 can take. The modules of Fig. 1 can comprise the library sub-agent 202,

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module 700 is responsible for the physical backup of files and/or data across several library media which it controls. For example, the media module 700 manages, controls, and maintains the library media devices 750, 760, 770, and 780. A file and/or data may be processed by the media module 700 as different copies of the same file and/or data spanning the various library media devices that it controls. Further, each archived copy of the data and/or file may itself span the individual library media devices 750, 760, 770, and 780.

A file 710 is archived on the storage device 750. A separate file spans the storage devices as a file portion 720 and a file portion 730 in the storage devices 760 and 770. A copy of the file 710, 710a, is maintained separately in the storage device 780. Additionally, the archived files may stored on a differential block basis. For example, the file 740 is stored on the library media device 780. However, at a later time, an incremental backup has determined that the file 740 has been altered, but only in one sector. The backup and retrieval system could operate in a fashion such that the backup of the altered version of the file 740 comprises only those sections of the file that have changed. Thus, the blocks 740a and 740b represent the portions of the file 740 that have changed. The file 740, when overlaid with the blocks 740a and 740b, stands for the current altered version of the file 740

Fig. 8 is a schematic block diagram of an embodiment of the modular backup system according to the invention. Typically, a modular backup system [800] comprises several software components, including a management component 810 communicatively coupled to least one client component 820, and at least one media component 830. There may be more than one client component 820, as well as more than one media component

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The management component 810 may also maintain the archives through various policies. The policies may include drive-cleaning policies, index pruning policies, aging policies, and library media volume maintenance. For example, the management component 810 may implement a policy that initially archives files and/or data on a relatively fast media. Upon another archival cycle, the management component 810 may relocate the first set of archived files and/or data to another slower type media, due to the presence of another set of a newly archived data and/or files. Alternatively, for example, older differential or incremental backups maybe completely deleted from an archive upon the completion and verification of a newer full backup. One skilled in the art should recognize that since the management component 810 is a software agent, these policies might be fully programmable automatically adaptable to changing conditions in the computing devices serviced by the backup and retrieval system, as well as traffic on a network or networks linking them. The management component 810 may contain the ability to implement one more of these policies in a fully adaptable archival management scheme.

The policies may include prioritizing the archived files and/or data to various library media 840, 850, and 860 according to various criteria. These criteria may include priorities of files as determined by a network or machine file system, as determined by a network or machine system administrator, or as determined by an application running on a network machine, for example. One skilled in the art should recognize that these policies are also fully adaptable in an archival management scheme.

The management component 810 is communicatively coupled to at least one media component 830. A media component 830 is a software agent that controls the

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library media 840, 850, and 860 that house the archived data. The management component 810 can direct the particular media component 830 controlling a particular library media 840, 850, and 860 to perform a particular archival request, such as a backup, or a retrieval.

In a backup function, the management component 810 could format or direct the particular files and/or data to the media component 830 for storage. The media component 830 would receive the files and/or data, and direct them to a particular library media 840, 850, and 860 that the media component 830 controls. Upon successful archival of the files and/or data to the library media 840, 850, and 860 , the media component 830 would then create an index detailing the location of the archived files and/or data on the library media 840, 850, and 860 . This index could include the actual media library device used and the parameters of that media library device where the particular file and/or data is located within the particular media library device. For example, if the media library device was a magnetic disk, the index created might contain the block, track, and sector numbers of the magnetic disk where the particular file and/or data is located on the magnetic disk. One skilled in the art should recognize that this index need not be restricted to a physical device, but may be extended to any addressable type device, including virtual devices. Further, one skilled in the art will recognize that each library media 840, 850, and 860 device could contain its own unique mode of operation and known unique mode of indexing any data or file stored on it.

A client component 820 directs and manages the archival functions of a particular computing device falling within the aegis of the backup system. A particular client component 820 directs and tracks the archival parameters for a particular computing device. Additionally, a particular client component 820 may also serve to interact with the management component 810 for unscheduled backup activities. A user may interface

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manages which library media <u>840, 850, and 860</u> should archive the particular files and/or data to be archived. This determination may also involve priority of the information.

The management component 810 then forwards the information to be archived to the particular media component 830 responsible for the library media <u>840, 850, and 860</u> that will be used in the archival action. The particular media component 830 responsible for the library media <u>840, 850, and 860</u> receives the information to be archived, and proceeds to direct the particular library media <u>840, 850, and 860</u> to archive the information as requested. The particular media component 830 records an index entry of the archived information. This index entry can contain an indication of the information archived, the particular library media <u>840, 850, and 860</u> which physically archives the information, and the address on the particular library media <u>840, 850, and 860</u> at which the information may be retrieved.

Upon a successful archival of the information on the library media <u>840, 850, and 860</u> the particular media component 830 proceeds to acknowledge that successful completion of the archival action by forwarding to the management component 810 information on the successful archival action. This information includes the indexing information by which the management component 810 may track and manage the archived information.

If the back up archival request by the particular client component 820 contains a list or indication of particular files and/or data to be archived, the management component 810 may acknowledge the request by requesting transmittal of the particular files and/or data by the particular client component 820. Once the management component 810 receives the particular files and/or data, the management component 810 determines the proper library media <u>840, 850, and 860</u> on which to archive the information. The management component 810 then requests that the particular media component 830

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responsible for the library media 840, 850, and 860 archive the data. The management

component 810 forwards the information about the data to be archived to the selected media

component 830. The selected media component 830 then coordinates the physical archival

action with the library media 840, 850, and 860. Upon a successful archival of the

information on the library media840, 850, and 860 , the particular media component 830

proceeds to acknowledge that successful completion of the archival action by forwarding to

the management component 810 information on the successful archival action. This

information includes the indexing information by which the management component 810

may track and manage the archived information.

In another embodiment, the management component 810 would determine a

specific library media 840, 850, and 860 on which to archive the information. It could then

pass the media component 830 responsible for that library media 840, 850, and 860 other

information by which the specific media manager 830 and the requesting client component

820 could establish communication between themselves. The data and/or files could then be

passed between the specific media component 830 and the requesting client component 820.

Alternatively, the management component 810 may initiate the archival action

based on the system-wide parameters as controlled by management component 810. For

example, the management component 810 may determine that a particular computing

device is due for a backup. This backup may be one for an incremental backup, a

differential backup, or a full backup. The management component 810 would then

request that the particular client component 820 responsible for interacting with and

managing the particular computing device make a determination of the files and/or data

that are due for the particular backup requested. The particular client component 820

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responsible for managing the particular computing device would then act to collect the files and/or data to be archived on the particular computing device.

In one embodiment, the particular client component 820 would forward to the management component 810 a description of the information to be archived from the computing device. This description may also contain an indication of the priority for the retrieval of the information provided. Thus, the management component 810 would then determine the proper library media 840, 850, and 860 on which to archive the information from the computing device. Upon receipt of this information and the determination of the proper library media 840, 850, and 860 to be used in the archival action for each file and/or data, the management component 810 may request the actual data and/or files from the particular client component 820 to be archived. The particular client component 820 may then forward the information to be archived to the particular media components 830 responsible for the actual physical archival action.

In another embodiment, the particular client component 820 would forward to the management component 810 both the files and/or data to be archived along with the corresponding information for each. In this embodiment, any network traffic between the management component 810 in the particular client component 820 would be reduced.

In yet another embodiment, the particular client component 820 would forward the information concerning the data and/or files to be archived to the management component 810. The management component 810 would then determine the proper library media 840, 850 and 860 or medium on which to archive the data and/or files. The management component 810 may then initiate the archival action by forwarding a request to the particular media components 830 selected to handle the physical archival actions. This

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request could contain the pertinent file information. The particular media components 830 may then request directly from the particular client component the files and/or data to be archived. Thus, in this case, the management component 810 indirectly manages the actual archival process. It indirectly manages the archival process by providing the files and/or data to be archived to the particular media components 830 by providing the information on the files and/or data. Additionally it provides the means to instigate communication directly between particular media components 830 and the particular client component 820.

In any case, the particular media components 830 manage and direct the physical archiving process. The particular media components 830 create an index entry for each file and/or data unit archived. Each particular media component 830 forwards batches of "metadata" back to the management component 810. This metadata contains that information by which the management component 810 may track and manage the archived data. The "metadata" may also contain information on the origination of the data and/or files, permissions associated with the data and/or files, and other administrative information.

The management component 810 tracks the archival process through the metadata passed back from the particular media components 830. Thus, for any given archived file and/or data, the management component when 810 can precisely track where the information is archived, even when portions of the archived data span several library media 840, 850, and 860 . Given the information as passed from the particular media components 830 to the management component 810 regarding the archived files and/or data, the management component 810 can track all versions of the archived information, including all full

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ABSTRACT

The invention is a modular backup and retrieval system. The software modules making up the backup and retrieval system run independently, and can run either on the same computing devices or on different computing devices. The modular software system coordinates and performs backups of various computing devices communicating to the modules. Actions of modules on one of the computing devices acts as a system manager for a network backup regimen. A management component acts as a manger for the archival and restoration of the computing devices on the network. It manages and allocates library media usage, maintains backup scheduling and levels, and supervises or maintains the archives themselves through pruning or aging policies. The management component is not hard wired in its functionality, but may adapt to changing circumstances in these policies. A second software module acts as a manager for each particular library media. [A media component supervises the actual media to which the backups are made and the retrievals are pulled from. The media component provides an indexing function which serves to specifically locate any data and/or files archived, as well as other administrative details about the data. This indexing information is made available to the management component for easier processing.]

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